

Khekeretnebtj. The King shared the same daughters, granddaughter and Lady L. The histological finding of atherosclerosis confirms his advanced age and reflects perhaps stresses arising from royal concerns. In the final section of the paper, there was discussion of the high radiocarbon dates, the relation of the King's age at death to his known regnal span and the question of the identity of his secondary wife - the mother of the said daughters.

References

- Batravi, A, 1947. 'The Pyramid Studies. Anatomical Reports', *ASAE* 47, 97-111.
- Beckerath, J von, 1975. 'Chronologie', *Lexikon der Ägyptologie*, I, 967-971.
- Brothwell, D R, 1963. *Digging up Bones*, British Museum (Natural History), London.
- Callender, G, 1989. *A Prosopography of Mr.s-cnh IV*, Private print, Thornleigh, Australia.
- Gardiner, Sir Alan, 1961. *Egypt of the Pharaohs*, Clarendon Press, Oxford.
- Haas, H, Devine, J, Wenke, R, Lehner, M, Woelfli, W, Bonani, G, 1987. 'Radiocarbon Chronology and the Historical Calendar in Egypt', in *Chronologies in the Near East*, Aurenche, O, Evin, J and Hours, F (eds.), BAR International Series 379, Oxford.
- Klíř, P, 1992. 'Blood Groups', in Strouhal, E, 1992.
- Lengyel, I A, 1975. *Palaeoserology*, Akademiai Kiadó, Budapest.
- Maragioglio, V, Rinaldi, C, 1975. *L'Architettura delle Piramidi Menfite*, Parte VIII, Officine Grafiche Canessa, Rapallo.
- Martin, R, Saller, K, 1957, 1959. *Lehrbuch der Anthropologie*, 3. Auflage, Band I-II, G Fischer, Stuttgart.
- Moursi, M, 1987. 'Die Ausgrabungen in der Gegend der Pyramide des Dd-K3-R' "Issj" bei Sakkarā', *ASAE* 71, 185-193.
- Mueller, B, 1975. *Gerichtliche Medizin*, Teil I, Springer, Berlin/Heidelberg/New York.
- Němečková, A, 1977. 'Histology of Egyptian Mummified Tissues from Czechoslovak Collections', *ZAS* 104, 142-144.
- Němečková, A, 1984. 'Histological Analysis', in Strouhal, E, 1984, 181-182.
- Němečková, A, 1992. 'Histological Comment', in Strouhal, E, 1992.
- Sandison, A T, 1955. 'The Histological Examination of Mummified Material', *Staining Technology* 30, 277.
- Strouhal, E, 1984. 'Princess Khekeretnebtj and Tisethor: Anthropological Analysis', *Anthropologie* 22, 171-183.
- Strouhal, E, 1992. 'Anthropological and Archaeological Identification of an Ancient Egyptian Royal Family (5th Dynasty)', *International Journal of Anthropology* 7, 43-63.
- Strouhal, E, Jungwirth, J, 1984. *Die anthropologische Untersuchung der C-Gruppen- und Pan-Gräber-Skelette aus Sayala, Ägyptisch-Nubien*. Denkschriften, 176 Band, Österreichische Akademie d. Wissenschaften, phil.-hist. Kl, Verlag d. Österr. Akad. d. Wissensch., Wien.
- Tesař, J, Klíř, P, 'Blood Groups', in Strouhal, E, 1984, 182.
- Woelfli, W, 1987. 'Advances in accelerator mass spectroscopy', *Nuclear Instruments and Methods in Physics Research*, B29, 1-13.

object (100 x 78 x 42 mm), possibly a small bag, with one smoothly convex side, the other side being flat and covered by a 25 mm thick layer of plaited strings into which a grey material (possibly lime) has been pressed and over which a black matter (probably resin) has been smeared (Plate 12,4). In addition, many loose pieces of finely woven ochre or brown linen wrapping have been preserved.

It was possible to use standard anthropological methods of investigation (Martin and Saller 1957, 1959, Brothwell 1963, Strouhal and Jungwirth 1984) only on a limited number of preserved features. Therefore, some unusual measurements and descriptive observations had to be undertaken, aimed at comparison with the purported daughters of the King.

4. Demographic Data

Sex Determination. The general robusticity of the cranial remains was medium to gracile. Both tubera frontalia and parietalia were only slightly developed; the right linea temporalis was present as an indistinct sign on the frontal scale only; the supramastoid crest was developed slightly. The profile of the forehead was oblique, arched fluently without any angular break, and the forehead was low. In addition the occipital scale was not angulated but curved fluently. No distinctive protuberantia occipitalis externa was developed, but there was a slight transverse eminence continuing laterally into an indistinct narrow torus occipitalis. The mastoid process was medium-long, anteroposteriorly broad, and mediolaterally rather thick, the incisura mastoidea being medium-large but deep. The nuchal muscular relief showed medium to strong development.

The mandible was mediumly robust with a mediumly developed muscular relief. The left mandibular angle, partially broken off, preserved evidence for an original eversion whose extent could not be ascertained. In spite of a missing lower border the shape of the chin was clearly square with outstanding, slightly elongated, tubera mentalia and a well differentiated pointed protuberance. The mylohyoid line was only slightly marked. The left condyle was rather big.

The postcranial bones were also mostly medium-robust to gracile with a medium to slightly developed muscular relief. The right tuber ischiadicum, whose edge has been preserved, was probably medium-sized, the right incisura ischiadica maior narrow and deep. On the lower side of the medial end of the left clavicle a small costoclavicular facet can be observed. The right humerus was perforated (6 x 5 mm).

The majority of diagnostically significant features point to the sex of the individual being male. At the same time, his body-build tended to gracility and somewhat underdeveloped muscular relief.

Age Determination. With regard to cranial sutures, the coronal one was completely fused inside, but outside only in C₁ and medial C₂ sections. Similarly the sagittal suture was completely gone inside, while outside remnants of suture can be found in S₃-S₄ sections. The right medial quarter of the lambdoid suture was still open, the right lateral quarter being closed inside and in a state of incipient closing outside. A slight sulcus sagittalis and shallow grooves (breadth 4-5 mm, depth 0.5-1 mm) along the anterior edges of both parietal bones (which were thinned up to 2-3 mm) can be observed.

Abrasion of the upper right canine and first premolar was very progressed with removal of more than half of the crown height but without any opening of the pulpar chamber (grade 7 of Strouhal and Jungwirth 1984). At the same time, the upper right second and third molars showed only enamel abrasion (grade 2), pointing to a premature loss of their antagonists. Similarly, the lower left second molar had only a facet of incipient enamel abrasion (grade 1) and the lower third molar a facet of incipient dentine abrasion (grade 3).

KING DJEDKARE ISESI AND HIS DAUGHTERS

Eugen Strouhal and Mohammad Fawzi Gaballah
with contributions by
Přemysl Klír and Alena Němečková
and the collaboration of Shelley R. Saunders and Willy Woelfli

1. Introduction

In mastabas in the southern part of the Fifth Dynasty royal cemetery at Abusir recently examined by the Czechoslovak Institute of Egyptology, Charles University Prague, physical remains of some members of the family of King Djedkare Isesi were found and submitted to an anthropological analysis. In Mastaba B, Princess Khekeretnebtu was buried with her probable daughter, Tisethor (Strouhal 1984); in Mastaba K, Princess Hedjetnebu, a sister of Khekeretnebtu, both the King's daughters 'of his own body' as testified by inscriptions and proved by archaeological and anthropological identification (Strouhal 1992). Mastaba L, situated in the next row of mastabas, belonged to an anonymous lady whose morphological distance from the aforementioned persons was clearly greater. She did not belong to the King's nuclear family, like the others, but could have been related to it more distantly.

In connection with these findings we started a search for the physical remains of the father of the two princesses, King Djedkare Isesi himself. We were aware that they had been discovered by an archaeological team led by the architect Abd El Salam M Hussein and the Egyptologist A Varille in the pyramid called 'Haram esh-Shawaf' ('Pyramid of the Sentinel') at the south-east angle of the plateau overlooking the village of Saqqara during the season 1945-46. The excavations proved that the pyramid had been built for King Djedkare Isesi and that the original name of it was 'Nefer' ('Beautiful').

An archaeological report was never published (Moursi 1987). We have at our disposal only some basic data contained in the anatomical report by the Egyptian anatomist and anthropologist M A Batrawi (1947). Fortunately, in the former anthropological collection of Professor Batrawi, which is housed in the Department of Anatomy, Kasr El Ainy Medical Faculty, we succeeded in finding a small box labelled in Batrawi's handwriting 'Remains of Mummy (Royal) Djed-Ka-Rê, Vth Dynasty, described by A Batrawi, ADSAE, no. 803-A', which contained the fragments published by the author (Batrawi 1947). Because Batrawi did not attempt an anthropological study but limited his paper to a listing of the preserved fragments and a description of their embalming method, we decided to re-examine the remains from the demographical and morphological points of view, in the case of the latter with a view to establishing a possible similarity between them and the remains of his daughters. The authenticity of the King's remains was tested by radiocarbon dating. Supportive evidence was sought in blood group determination and histological analysis. The material was studied in the Department of Anatomy in Cairo and radiographically examined at the Radiological Clinic of Professor Dr Hoda A El-Deeb in Cairo in December 1988.

2. Authenticity of the Remains

In spite of the fact that the exact findspot of the King's remains was never described or drawn on a plan, Batrawi (1947) gave three reasons for his belief 'that that body must have been the original and the only body which was buried inside the pyramid', viz.:

1. The original entrance into the pyramid was found to be closed by a huge granite block. There was no other passage except for a narrow tortuous channel made by ancient plunderers which would not allow insertion of an intrusive burial.

2. Several 'shapeless masses' composed of wrapping-cloth soaked in resin were recovered from a small pit, dug in the floor of the burial chamber, in which a piece of a Canopic jar inscribed with the King's name was also found. It seems probable that some of these wrappings contained viscera, originally preserved in Canopic jars.

3. The preserved human remains showed no duplication and were all in the same state of preservation, betraying their origin from one and the same body, buried originally in the pyramid.

In order to test this hypothesis and to exclude definitively the possibility of an intrusive burial, a few samples were removed from the remains and together with samples from both the princesses they were submitted for radiocarbon dating at the Eidgenössische Technische Hochschule Zürich (thanks to the generosity of Professor Dr Willy Woelfli, the Director of the Institut für Mittelernephysik) using the AMS-technique (Woelfli 1987). The results, kindly submitted to us in a personal communication of November 30, 1990, were summarised by Professor Woelfli as in Table 1.

A few comments were added by Professor Woelfli to his tabulated results. With the weighted means two errors are listed. One is the weighted statistical error derived from errors of the single measurements, the other reflects the variance of the single results. The applied χ^2 test betrays in the first weighted mean a too-high variance resulting in only 0.13% probability of the normal distribution of the single values around the mean.

The result from ETH-5334 stands so markedly apart from the statistical grouping that it was eliminated from consideration. It was a sample of body tissue that was so soluble in water that it was not possible to purify it chemically. Moreover, we have to suspect that the King's body was saturated by embalming solutions that could not be removed. Therefore, the resultant date has to be considered a mixed one, as suggested also by the abnormally high $\delta^{13}C$ value. Excluding this sample from the grouping, we get the second weighted mean with a higher (3.44%) probability of normal distribution. Even this is not very convincing, but we must take into consideration that the daughters were, minimally, twenty years younger than Djedkare, thus causing the greater value of the variance compared with that of the statistical error.

We may conclude - with all caution - that King Djedkare Isesi and both princesses are proven to be contemporaries. This result is a further strong argument for accepting the authenticity of the King's remains.

3. Material and Methods

The fragments listed by Barrow (1947) were carefully prepared in order to obtain tissue for histological examination and to expose bones which could have been, in some cases, joined together. In some fragments, where the soft tissue layers were too thick, the integrity of the piece was preserved and radiography was applied as a method of investigation.

The newly arranged fragments comprise the following regions or items:

1. The anterior half of the calva consisting of the incomplete squama frontalis, the left parietal bone and the anterior lateral quarter of the right parietal bone (Plate 9,1).

Table 1. Radiocarbon dating of samples related to Djedkare Isesi and his daughters

Person	Laboratory No.	Sample	Conventional C ¹⁴ -age (BP) ¹	$\delta^{13}C$	Calibrated age range (BC) ²
Djedkare	ETH-4340	DI-O mummy wrapping (linen)	4025 \pm 55	-25.4	2864-2460
	ETH-5334	DI-1 body soft tissue	4385 \pm 80	-14.4	3340-2787
	ETH-5335	DI-2 charcoal	4200 \pm 75	-21.2	3014-2580
	ETH-5336	DI-3 mummy wrapping (linen)	4235 \pm 75	-22.8	3031-2612
Hedjetnebu	ETH-5337	12/K/87 mummy wrapping (linen)	4205 \pm 65	-24.8	2920-2600
Khekeret- nebty	ETH-6949	170/B/76 mummy wrapping (linen)	4020 \pm 65	-22.3	2869-2403
First weighted mean (of 6 examples)			4152 \pm 28/55 ($\chi^2=4.0$, P=0.13%)	-	2910-2580
Second weighted mean (without ETH-5334)			4121 \pm 30/48 ($\chi^2=2.6$, P=3.44%)	-	2886-2507

Explanations

1 = all error values are $\pm 1\sigma$

2 = ranges are $\pm 2\sigma$ (probability 95%)

2. The posterior medial quarter of the right parietale which has contact points with the previous fragment but cannot be joined to it (Plate 9.2, right).
3. The incomplete squama occipitalis, mostly from the right side (Plate 9.2, left).
4. Soft tissues of the left posterior inferior part of the face with the temporal region containing the shrunken auricle and a part of the left neck wall (Plate 9.3). Inside the fragment parts of the left zygomatic, ethmoid, sphenoid and temporal bone (pyramid) can be found.
5. The incomplete alveolar process of the right maxilla with the anterior lateral quarter of the processus palatinus and the teeth row from right upper C to M3 in situ (Plate 9.4).
6. The left half of the mandible with the second and third left lower molars in situ (Plate 10.1).
7. The sternum with attached left clavicle (without its lateral third), left first rib (posterior end missing) and medial ends of six left and four right ribs. The fragment is covered externally by muscles, subcutaneous tissue, skin, textile and grey stucco (Plate 10.2), internally by the periosteum and possibly pleura (Plate 10.3).
8. The vertebral column from C₁ (left half) to T₅ held together by ligaments, muscles and the remains of skin on the rear. A fragment of the distal third of body T₆ connected with the whole body T₇, preserved separately (Plate 11.1). An isolated perforated intervertebral disc from the lumbar section of the spine (Plate 12.3, right) as well as six rib-fragments.
9. Postmortally broken fragment consisting of the distal end of the left humerus with proximal ends of the antebrachial bones (Plate 11.2).
10. Metacarpals and proximal phalanges of both first fingers, the metacarpal and all phalanges of the left second finger, the metacarpal of the left third finger and the left trapezium and trapezoidium.
11. A part of the right os coxae containing the acetabulum, incisura ischiadica and the edge of the tuber ischiadicum (Plate 11.3).
12. The proximal sixth of the left femur with the originally adhering incomplete rim of the left acetabulum (Plate 11.4).
13. The lateral (fibular) half of the left foot from the os naviculare to the tips of the third-fifth toes (Plate 12.1).
14. Several fragments of compact bone originating from the long bones of the extremities.
15. Several fragments of soft tissue, some with skin covered by adhering fine linen wrapping, e.g. an outside convex piece from one of the shoulders with remnants of muscle and sinew on its concave inside (Plate 12.2).
16. Several fragments of pads and bags composed of many layers of textile soaked in a black substance (most probably resin). One of the pads has been smeared on its flat, somewhat concave, side with a layer of lime in which a green faience tubular bead has been fixed (Plate 12.3, left). A spheric oblong

object (100 x 78 x 42 mm), possibly a small bag, with one smoothly convex side, the other side being flat and covered by a 25 mm thick layer of plaited strings into which a grey material (possibly lime) has been pressed and over which a black matter (probably resin) has been smeared (Plate 12,4). In addition, many loose pieces of finely woven ochre or brown linen wrapping have been preserved.

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with third molars, dentition at the supragingival level. Of the preserved postcranial bones, the cervical and upper thoracic parts of the spine could not be inspected directly, because they were still covered by the ligaments. From the radiogrammes, it was possible to detect the practical absence of osteophytes (Plate 13,1-2), which were, however, present at the top of the dens epistrophei (3 mm long). At the same time, cartilaginous parts of the ribs were already ossified and the corpus sterni fused with the processus ensiformis (Plate 13,3), while the manubrium sterni remained separate. The left femoral head showed a partially filled-up foveola and an area of arthritic erosion. No age or pathological changes were found in the area of articular joints (Plates 13,4 and 14,1).

From the histological report (see further), we may quote that brown pigment was still present in the hair, but atherosclerotic changes could be found in some minute blood vessels.

Summing up the features, an advanced age of between 50 and 60 years is suggested. This agrees with the original determination of about 50 years by Barawi (1947). The single feature that does not agree with this determination is the absence of the osteophytosis of the spine, which seems generally to have begun in ancient Egyptians around thirty years of age. Together with the aforementioned limited development of the muscular system, this points to a physically inactive way of life, with no heavy or excessively burdensome work on the individual's part.

We may add that the histomorphometric analysis at the midshaft compacta of the left humerus of Djedkare Isesi performed by Professor Shelley Saunders yielded an age estimate of 52.8 ± 8.5 years (written communication of October 29, 1991) which fits well the determination mentioned above. The King's age at death lay thus in the range of 45-60 years.

5. Other Descriptive Features

5. Other Descriptive Features The profile curve of the cranial vault was slightly depressed postbregmatically, as in the skull of the Princess Khekeretnebu. The obelic region was flattened up and back as in the remains of Hedjetnebu. The wormian bones were present in the lateral parts of the coronal suture and probably also in the lambdoid suture. An Inca bone was not developed. The cranial outline in the vertical norm was possibly ovoid.

The vertical norm was possibly ovoid. The left zygomatic bone bulged prominently to the side. The lower edge of the piriform aperture was in the form of a low crest. The subnasal region showed a wavy relief. Both the upper and lower dental rows were most probably elliptic and rather small. The depth of the palate was medium and concave anteriorly.

From the upper right teeth, I2 was lost postmortally, C and P1 were present and healthy, from P2 a secondarily broken-off torso survived, M1 was lost infra vitam and both M2 and M3 were present without pathological changes. Of the lower left teeth, the incisors and the canine were lost postmortally, the alveolus of P1 was damaged and the tooth lost postmortally, as were P2 and M1, while M2 and M3 remained in situ and healthy. The upper right M2 was a fusiform with a strongly reduced hypoconus. Its neighbouring M3 had only three cusps. The lower left M2 showed the usual cruciform pattern of furrows, dividing the four cusps. On the adjoining M3 the number of cusps and pattern of furrows were probably the same. No Carabelli cusps were

present on the upper right M₂ and M₃. No crowding appeared in the lower frontal dentition.

The preserved left auricle had a rolled up posterior half. Its original height was 57 mm, the breadth being reduced by rolling to 17 mm only. The external auditory meatus was also narrowed by it (height 5 mm, breadth only 2 mm).

6. Comparison of Metric Features

A few of the currently used craniometric features, complemented by some atypical ones, could be measured in the remains of King Djedkare Isesi, as well as in the skulls of his daughters Hedjetnebu and Khekeretnebt, of his granddaughter Tisethor and of the possibly more distantly related woman L (Table 2). One would have expected the King's dimensions, being those of a male, to be greater than those of the four females. In reality, however, this was the case only with the maximum frontal breadth, the height and breadth of the ascending ramus, and to a lesser extent with the minimum frontal breadth and the height of the mandibular body between M₂ and M₃. In the other features, the King's values were close to those of the compared females (differing maximally 1 mm). This appears in such significant features as the development of the mastoid process, both the height and thickness of the mandibular body and even the thickness of the cranial vault. The state of these features is not just the result of the underdevelopment of the muscular system, but also expresses the striking gracility of the King's cranial structure.

Measurements of the four preserved molars of the King showed mostly similar values in comparison with homologous molars of the four females (Table 3). Both the King's upper and lower third molars were mesiodistally longer, while the diameters of his lower second molar and the buccolingual breadth of his third lower molar were paradoxically both slightly shorter than those of the females. This finding suggests that in the King's gracility and shorter dimensions genetic background also played a role.

A few of the currently used osteometric features, complemented by some atypical ones, were able to be determined in the King's and the four females' remains (Table 4). In the case of these features a still greater sexual differentiation might have been expected than that in the craniometric features. This was actually the case with seventeen of the measurements, viz. the ventral vertical diameters of the vertebrae C₂, C₃, C₆, T₅ and T₇, the length and breadth of the manubrium sterni, the thickness of the anterior end of the first rib, the circumference of the mid-diaphysis of the clavicle, the lower epiphyseal breadth of the humerus, the breadth of the upper edge of the tuber ischiadicum, the transverse breadth of the trochanter minor and the three dimensions of the femoral head. These results fitted well the male sex of the King. In the eleven remaining measurements, however, the King's values were close to those of the compared females (differing maximally 1 mm) with the exception of the still smaller ventral vertical diameter of the vertebra T₄. Some other osteometrics of the King (Table 5), which had no counterparts in the skeletal parts preserved with the four females, were also consistent with the sex being male, while at the same time showing a tendency to gracility as well as to shorter stature.

We should note that gracility and short stature were the most outstanding features of the four compared females (Strouhal 1990).

7. Blood Groups (by P. Klír)

In addition to the previously tested samples of tissue from the bodies of Princess Khekeretnebt and her probable daughter Tisethor (Tesař and Klír 1984), as well as from those of the Princess Hedjetnebu and Lady L (Klír 1992), the remains of King Djedkare Isesi were also recently examined.

Table 2. Craniometric comparison between Djedkare Isesi, his family members and Lady L

No.	Measurement	Djed-kare	Hedjet-nebu	Khekeret-nebty	Tisethor	Lady L
9	Minimum frontal breadth	95	93	91	91?	90
10	Maximum frontal breadth	114	108	109	110	108
16	Breadth of the foramen magnum	27?	28	27	-	26
60	Maxilloalveolar length	52?	47	51	47	53
ML	Length of the mastoid process	30?	26	29 R	28	26
MT	Thickness of the mastoid process	14?	10	13 R	10	11
69.1	Height of the mandibular body	29?	29	29	23	27
69.3	Thickness of the mandibular body	11?	8	9	10	11
70	Height of the ascending ramus	65?	58	57?	58	58
71	Minimum breadth of the ascending ramus	33	27	28	30	28
79	Gonial (mandibular) angle	118?	118	122	121	124
-	Cranial thickness at left tuber frontale	5	-	5	-	7?
-	Cranial thickness at right tuber frontale	5	-	5	5	7
-	Cranial thickness at left tuber parietale	5	6	5	6	7
-	Height of the mandibular body between M ₂ and M ₃	27	25	24	24	22
-	Thickness of the mandibular body between M ₂ and M ₃	14	12	13	14	14

Table 3. Odontometric comparison between Djedkare Isesi, his family members and Lady L

Tooth	Measurement	Djed- kare	Hedjet- nebu	Khekeret- nebt	Tisethor	Lady L
M ₂ ---	Mesiodistal diameter	10	9	-	9.5	-
	Buccolingual diameter	9.5	10	-	9.5	-
M ₃ ---	Mesiodistal diameter	9.5	-	8	-	-
	Buccolingual diameter	10	-	10.5	-	-
IM ₂ 	Mesiodistal diameter	8.5	9	10	10	-
	Buccolingual diameter	8	8.5	9.5	9.5	-
IM ₃ 	Mesiodistal diameter	11	-	9.5	9.5	-
	Buccolingual diameter	8.5	-	9	9	-

Table 4. Osteometric comparison between Djedkare Isesi, his family members and Lady L

Bone/ number	Measurement	Djed- kare	Hedjet- nebu	Khekeret- nebtu	Tisethor Lady L
Vertebrae					
C ₂	Ventral vertical diameter	39	34	34	33
C ₃	Ventral vertical diameter	12?	11	-	-
C ₄	Ventral vertical diameter	13	12	9	11
C ₅	Ventral vertical diameter	14?	10	-	-
C ₆	Ventral vertical diameter	14?	12	11	-
C ₇	Ventral vertical diameter	15	14	11	-
T ₁	Ventral vertical diameter	15	14	13	-
T ₂	Ventral vertical diameter	15	16	14	-
T ₃	Ventral vertical diameter	15	16	-	-
T ₄	Ventral vertical diameter	13	16	-	-
T ₅	Ventral vertical diameter	17	15	-	-
T ₆	Ventral vertical diameter	20	16	-	16
Sternum					
2	Length of the manubrium	61	-	-	-
4	Breadth of the manubrium	61	-	-	-
1st rib					
-	Thickness of the anterior end	9?	6 R	-	7 R
-	Thickness in the middle	4	4 R	-	4 R

Table 4 (cont.) Osteometric comparison between Djedkare Isesi, his family members and Lady L

Bone/ number	Measurement	Djed- kare	Hedjet- nebu	Khekeret- neby	Tisethor	Lady L
Clavicle						
6	Circumference of the mid-diaphysis	40	30 R	28	27	31
Humerus						
4	Lower epiphyseal breadth	62? R	51 R	-	-	53 R
Coxae						
22	Maximum diameter of the acetabulum	48	-	-	45 R	47
-	Breadth of the upper edge of the tuber ischiadicum	30	-	-	-	25
-	Thickness between the centre of the acetabulum and the lower edge of the incisura ischiadica maior	26	21	-	18	22
-	Thickness of the iliac wing on the linea arcuata above the apex of the inc. ischiad. maior	23	17	-	17	17
Femur						
-	Proximo-distal length of the trochanter minor	25	24 R	-	20	14
-	Transversal breadth of the tranchanter minor	16	14 R	-	13	13
-	Prominence of the trochanter minor (viewed from medial side)	11	10 R	-	-	11
18	Vertical diameter of the caput	45	37	-	-	39
19	Transversal diameter of the caput	45	38	-	-	39
20	Circumference of the caput	146	123?	-	-	125

Table 5. Other osteometrics of Djedkare Isesi

Bone/ number	Measurement	Value	
Sternum	Length of the sternum	156	
-	Length of the corpus sterni	85 ?	
3	Length of the processus ensiformis	10	
-	Breadth of the corpus sterni	42 ?	
5	Breadth of the processus ensiformis	17	
Clavicle	Height of the medial end	29	
-	Antero-posterior thickness of the medial end	23	
Hand			
2	Length of the 1st metacarpal	50 L	50 R
2	Length of the 3rd metacarpal	65 L	- R
3	Length of the 1st proximal phalanx	34 L	35 R
3	Length of the 2nd proximal phalanx	37 L	- R
3	Length of the 2nd medium phalanx	23 L	- R
Femur			
16	Minimum antero-posterior diameter of the neck	25	

Explanations for Tables 2 - 5 :

Pair measurements were done usually on the left side or on both sides (L = left, R = right).

Numbered measurements are those of Martin and Saller (1957, 1959); others are introduced by the present authors.

Two methods were used: the absorption method (Mueller 1975:117, Lengyel 1975:17-18) with anti-A and anti-B sera (titre 1:64) and the absorption-elution method with anti-A and anti-B sera of a higher titre (1:256). The absorption phase lasted 24 hours in a temperature of 4°C. For testing the decrease of titre in the absorption method after the absorption phase, 1% solution of erythrocytes of groups A and B was used. In the case of the absorption-elution method this solution of erythrocytes was mixed with SAGH (serum antiglobulinum humanum).

Samples were first cleaned and, before the actual examination, crushed. All samples were tested by both methods except hair which - due to the small amount of material - was analysed by the absorption-elution method only. All tests were repeated several times.

From the remains of King Djedkare Isesi fragments of soft tissue from the left side of the face and from the left os lunatum were used for blood typing. Both samples consistently showed blood group A, on repeated analyses.

The identical blood group A also characterised Princesses Khekeretnebtj and Hedjetnebu, the probable daughter of Khekeretnebtj, Tisethor and Lady L (Tesař and Klír 1984, Klír 1992).

8. Histological Analysis (by A. Němečková)

Samples of soft tissue from the princesses have been identified in our previous contributions. From Khekeretnebtj, muscular and brain tissue (Němečková 1984), from Hedjetnebu, brain tissue and hair (Němečková 1990) have been identified. No abnormality or pathological change were evidenced.

Three fragments of tissue from King Djedkare Isesi are dealt with in the present report. Macroscopically they were dry, of light brown colour, originating from the scalp.

At first we processed the specimens by classic histological methods. Small pieces of tissue were fixed in 10% formaldehyde and transferred over metacrylate into paraffin. For staining, hematoxylin and eosin, orcein, and the method after Verhoeff's hematoxylin were applied.

For observation in an electron microscope we carried out a special processing. Having softened the tissue according to Sandison (1955), we transferred the specimens in glutaraldehyde solution in an 0.5 M phosphate buffer. Minute particles of the tissue were postfixed in 1% osmium dioxide in an 0.1 M phosphate buffer and in 0.1 M saccharose prior to being dehydrated and embedded in EPON 812. Ultra thin sections were made on an ultramicrotome and were contrasted with uranylacetate and lead citrate.

By classic histology we succeeded in processing specimens of the skin. In the corium, collagen and elastic fibres were well represented. Desiccation of the tissue had resulted in a considerable deformity of blood vessels, whose preserved walls revealed remains of the media and adventitia (Plate 14,2,A). In some minute blood vessels a pathological substrate in the form of an increased fibrous centre revealed degenerative atherosclerotic changes (Plate 14,2, arrow, and Plate 14,3). A cross-section of the hairs showed tiny granulae of brown pigment.

Remnants of epidermis were also investigated by electron microscopy. Inside the epithelium forming epidermis we found cells with projections that were covered with intercellular substance (Plate 14,4,A). The cells were interconnected by broken desmosomes into which indistinct tenofilaments in the cytoplasm were fixed (Plate 14,4,C). In most cells we found keratohyalin granulae differing in shape and forming clusters. These granulae were coated with a distinct membrane (Plate 14,4,B).

The mummified tissue which has been studied showed structures quite comparable with those of recent times, notwithstanding the great chronological distance. Connective tissue, fibrous protein collagen and elastin proved to be the main solid structures of our specimens. These fibres

appear to resist well both chemical and climatic influences. As to the adipose connective tissue, we have not found as many fatty cells within it as were noted in any of our previous investigations (Němčková 1977, 1984).

9. Discussion

The radiocarbon dating which has proved the contemporaneity of King Djedkare Isesi and his daughters may strike Egyptologists as producing too-high a result. The second calibrated age range (2886-2507 BC), compared with the accepted ranges for the Fifth Dynasty, whose penultimate sovereign was Djedkare Isesi (2505-2345 BC in its higher or 2460-2310 BC in its lower version) (von Beckerath 1975: 967-971), appears to be 381-162 or 426-197 years too old. On the other hand, this result agrees well with the radiocarbon dating of sixty-four samples of organic remains taken from the major Saqqara, Abusir and Giza monuments of the Third to Sixth Dynasties, whose dates were older by at least three centuries than those established by traditional historical reconstruction (Haas et al. 1987: 597).

The advanced individual age of the King's remains, as now determined (45-60 years), can be compared with the available data on his regnal span. The Turin Canon indicates 28 years (Gardiner 1961: 435). An alabaster vase made for his Sed-festival (which took place usually in a king's 30th regnal year) is known from the Louvre Museum (Maragiglio and Rinaldi 1975: 64). A fragment of the Abusir papyri (Louvre E 25416a) yields the date of the sixteenth census of cattle carried out under Djedkare Isesi. As the census took place every two years, he should have reigned at least 32 years (Maragiglio and Rinaldi 1975: 64). In Manetho's list he is called "Tancheres" and is assigned as many as 44 regnal years (Gardiner 1961: 435). Neither of these dates contradicts the King's individual age.

We have not yet mentioned one very important member of the family which we have been investigating: the King's wife and mother of the two princesses. Most probably she was not the Great Queen (the first or main wife) for whom a pyramid - the largest funerary monument for a queen of this period - was built northeast of the King's pyramid (Maragiglio and Rinaldi 1975: 98). In the few published reliefs she appears as the royal wife of Djedkare Isesi but her name has not survived. A fragment of a probable decree mentions a daughter probably connected with this queen (Moursi 1987, Abb. 13).

Another king's wife, Meresankh IV, was buried in mastaba D 5 at Saqqara North, not far from the mastaba, D 3, of her son Raemka (Callender 1989: 4). This queen was also most probably not related to the princesses buried in the remote traditional cemetery of the previous Fifth Dynasty kings at Abusir.

Yet another, hitherto unknown wife of King Djedkare Isesi, very probably buried not far from the burial-place of her daughters Hedjetnebu and Khekeretnebt and of her granddaughter Tisetor, has to be postulated theoretically at Abusir. One of the candidates, from the same group of mastabas, could be the anonymous Lady L. This hypothesis can only be tested when excavations in the neighbourhood of this burial group have been completed. They might reveal a mastaba of another king's wife, the mother of the two princesses.

10. Summary

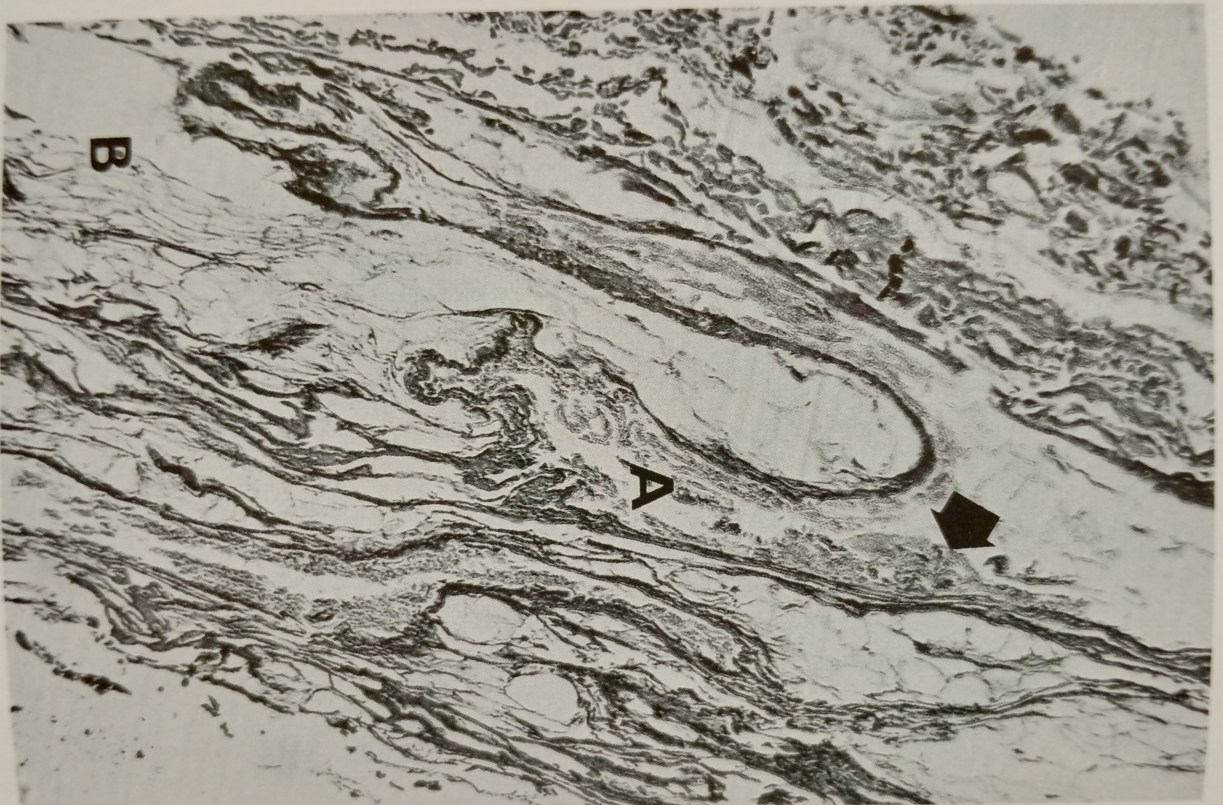
In considering the hypothesis of Batrawi (1947) on the authenticity of King Djedkare Isesi's remains, we may conclude, on the basis of the circumstances of their discovery and from the results of the radiocarbon dating, that their contemporaneity with the burials of the two princesses has been confirmed. In spite of several feminine features, medium to gracile body-build and the majority of developed muscular relief, the sex of the King's remains is male almost completely devoid of ageing features - with the exception of the spine which is

range of 45-60 years. The King's way of life was physically relatively inactive and free of hard or heavy work. Despite the difference in sex, a striking similarity between the King's and his daughters' values was found in cranial and dental measurements, emphasising his gracility. In the postcranial measurements the sexual difference was more marked, but again the tendency to gracility and shorter stature was obvious. The same features were characteristic of the princesses. Of the descriptive features, the postbregmatic depression of the King's skull was similar to that of Khakeretnebty. The King shared the same blood group, A, with his daughters, granddaughter and Lady L. The histological finding of atherosclerosis confirms his advanced age and reflects perhaps stresses arising from royal concerns. In the final section of the paper, there was discussion of the high radiocarbon dates, the relation of the King's age at death to his known regnal span and the question of the identity of his secondary wife - the mother of the said daughters.

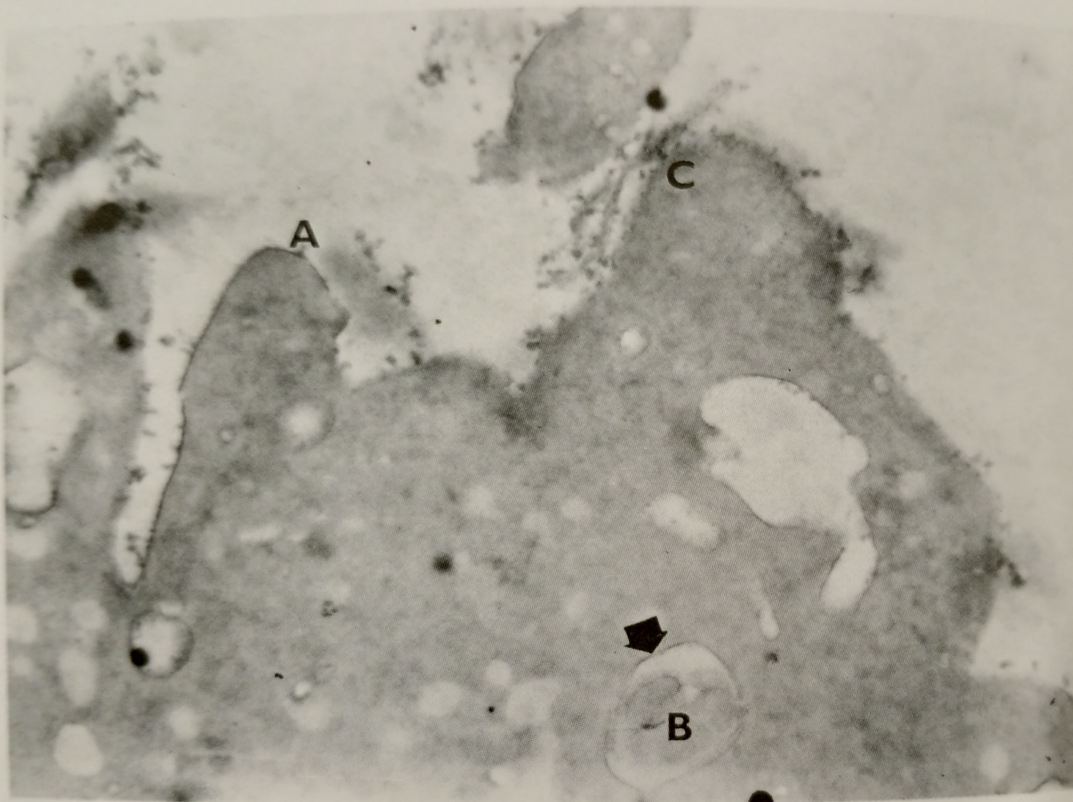
References

- Batravi, A, 1947. 'The Pyramid Studies. Anatomical Reports', *ASAE* 47, 97-111.
- Beckerath, J von, 1975. 'Chronologie', *Lexikon der Ägyptologie*, I, 967-971.
- Brothwell, D R, 1963. *Digging up Bones*, British Museum (Natural History), London.
- Callender, G, 1989. *A Prosopography of Mr.s-^{cnh} IV*, Private print, Thornleigh, Australia.
- Gardiner, Sir Alan, 1961. *Egypt of the Pharaohs*, Clarendon Press, Oxford.
- Haas, H, Devine, J, Wenke, R, Lehner, M, Woelfli, W, Bonani, G, 1987. 'Radiocarbon Chronology and the Historical Calendar in Egypt', in *Chronologies in the Near East*, Aurenche, O, Evin, J and Hours, F (eds.), BAR International Series 379, Oxford.
- Klíř, P, 1992. 'Blood Groups', in Strouhal, E, 1992.
- Lengyel, I A, 1975. *Palaeoserology*, Akademiai Kiadó, Budapest.
- Maragioglio, V, Rinaldi, C, 1975. *L'Architettura delle Piramidi Menfite*, Parte VIII, Officine Grafiche Canessa, Rapallo.
- Martin, R, Saller, K, 1957, 1959. *Lehrbuch der Anthropologie*, 3. Auflage, Band I-II, G Fischer, Stuttgart.
- Moursi, M, 1987. 'Die Ausgrabungen in der Gegend der Pyramide des Dd-K3-R' "Issj" bei Sakkara', *ASAE* 71, 185-193.
- Mueller, B, 1975. *Gerichtliche Medizin*, Teil I, Springer, Berlin/Heidelberg/New York.
- Němečková, A, 1977. 'Histology of Egyptian Mummified Tissues from Czechoslovak Collections', *ZAS* 104, 142-144.
- Němečková, A, 1984. 'Histological Analysis', in Strouhal, E, 1984, 181-182.
- Němečková, A, 1992. 'Histological Comment', in Strouhal, E, 1992.
- Sandison, A T, 1955. 'The Histological Examination of Mummified Material', *Staining Technology* 30, 277.
- Strouhal, E, 1984. 'Princess Khakeretnebty and Tisethor: Anthropological Analysis', *Anthropologie* 22, 171-183.
- Strouhal, E, 1992. 'Anthropological and Archaeological Identification of an Ancient Egyptian Royal Family (5th Dynasty)', *International Journal of Anthropology* 7, 43-63.
- Strouhal, E, Jungwirth, J, 1984. *Die anthropologische Untersuchung der C-Gruppen- und Pan-Gräber-Skelette aus Sayala, Ägyptisch-Nubien*. Denkschriften, 176 Band, Österreichische Akademie d. Wissenschaften, phil.-hist. Kl, Verlag d. Österr. Akad. d. Wissensch., Wien.
- Tesář, J, Klíř, P, 'Blood Groups', in Strouhal, E, 1984, 182.
- Woelfli, W, 1987. 'Advances in accelerator mass spectroscopy', *Nuclear Instruments and Methods in Physics Research*, B29, 1-13.

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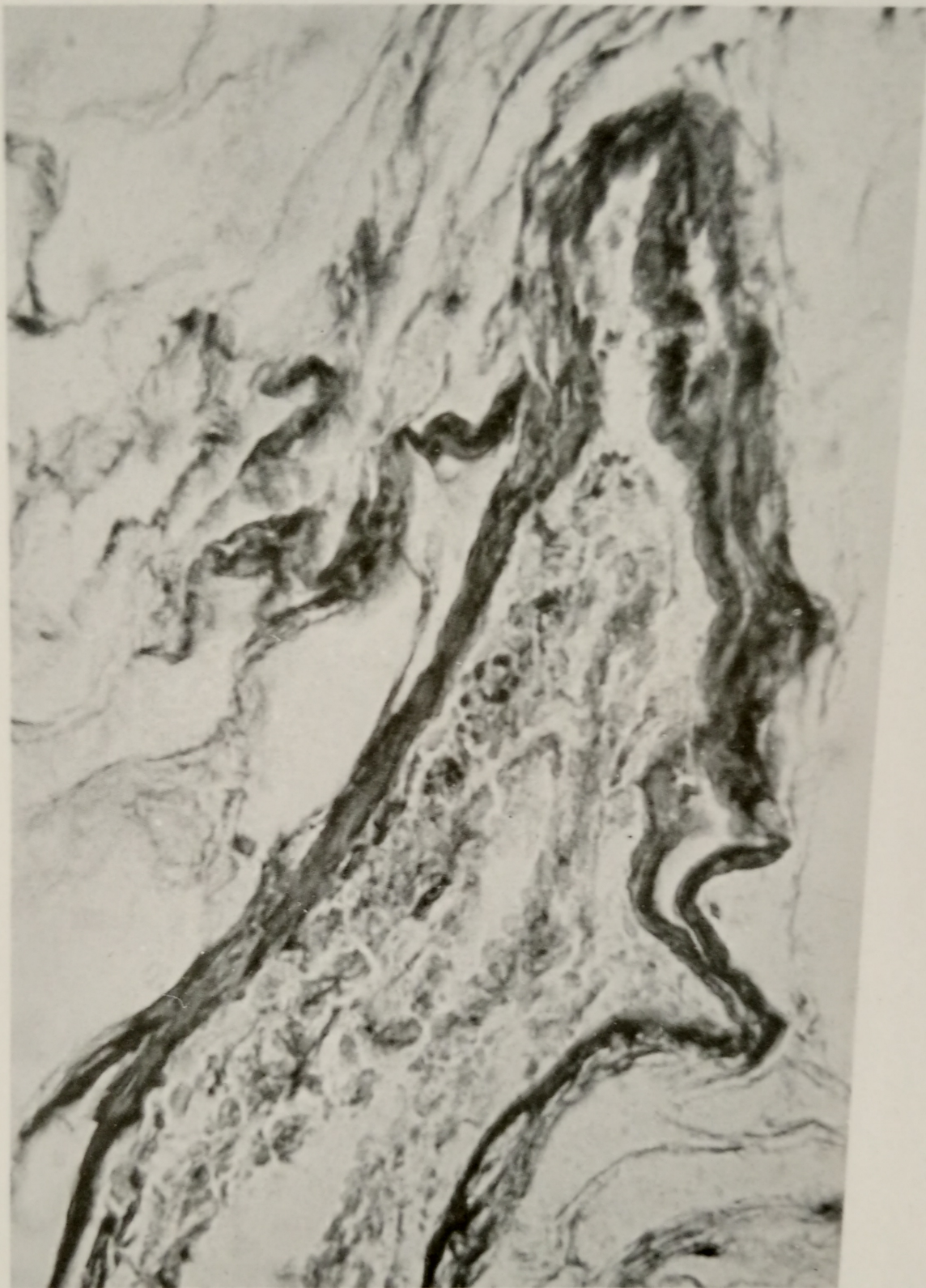


2. Microphotograph of a thin section of skin stained by Verhoeff's haematoxylin. A = reticular layer of dermis and a blood vessel. B = subcutaneous adipose tissue (40x).



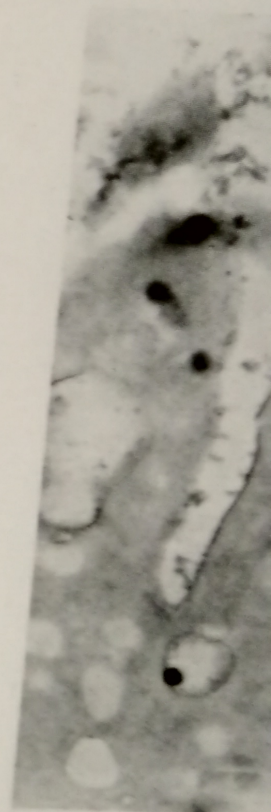
4. Electron micrograph of skin. The cells of the stratum germinativum with cells' membrane, A; keratohyalin granules, B; and desmosome, C (10,000x).

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skeleton with r
changes, which
variously attrib
rickets or osteo
imperfecta. RO
No provenance



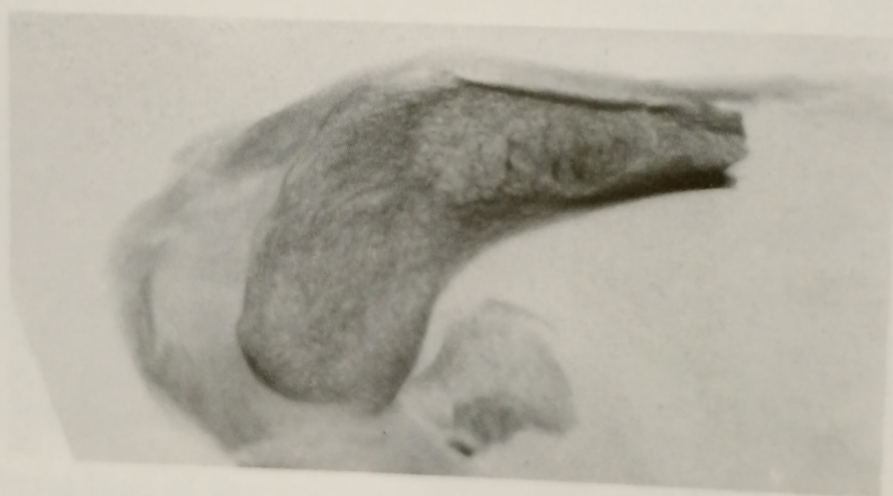
3. Microphotograph of a thin section of skin stained by Verhoeff's haematoxylin, showing a vessel with degenerative changes of its wall and obliteration of its lumen caused by atherosclerosis (190x).

2. M
Verho
blood

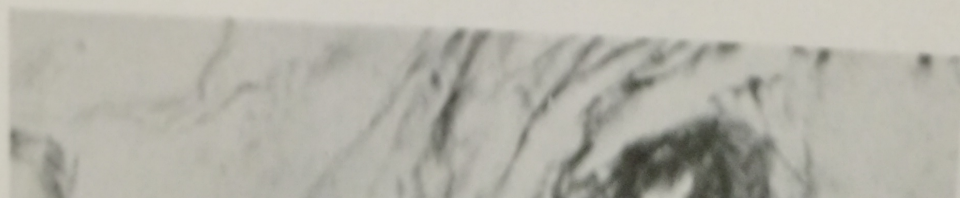


4. Electron micrograph of a cell junction (germinativum w B; and desmoso

PLATE 14



1. Radiogram of the lateral half of the left foot (*above*) and of the shoulder fragment with the lateral part of a clavicle (*below*).



2. Micrograph of a tissue section (Verhoeff).



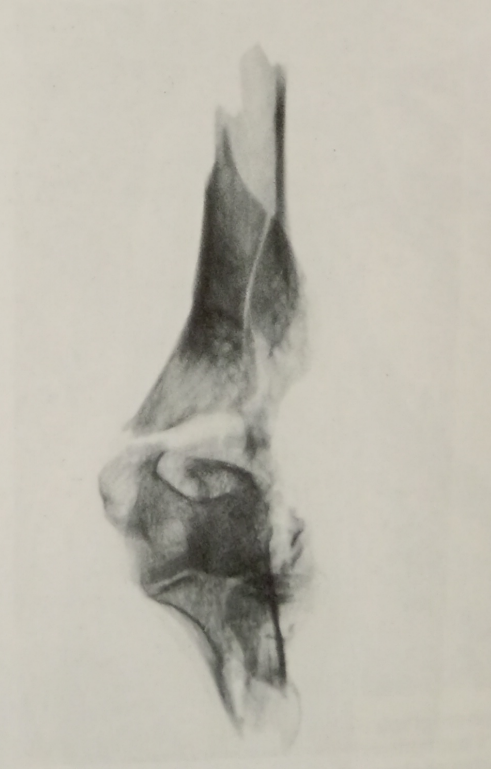
1. Antero-posterior radiogram of the cervical and upper thoracic spine.



2. Lateral radiogram of the cervical and upper thoracic spine.



3. Radiogram of the sternum with attached left clavicle and ribs.



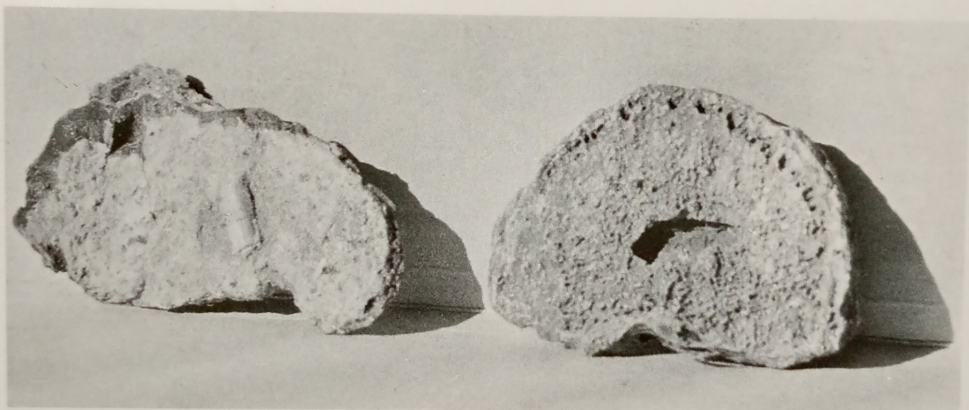
4. Radiogram of the postmortally-broken left cubit region.



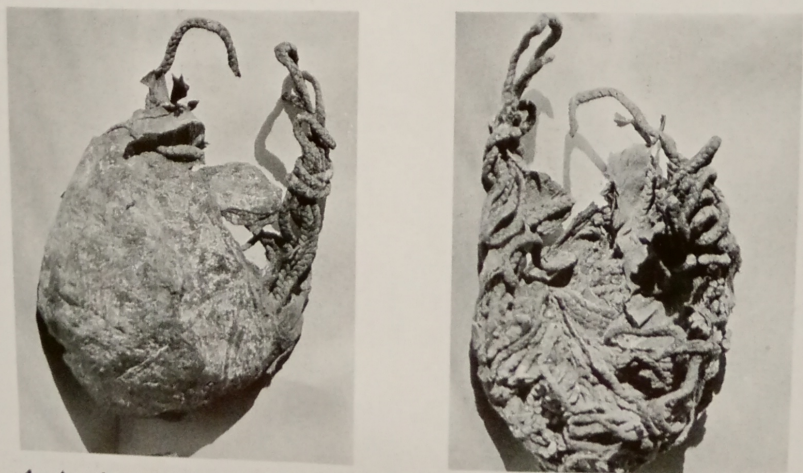
1. The lateral half of the left foot from naviculare to tips of toes.



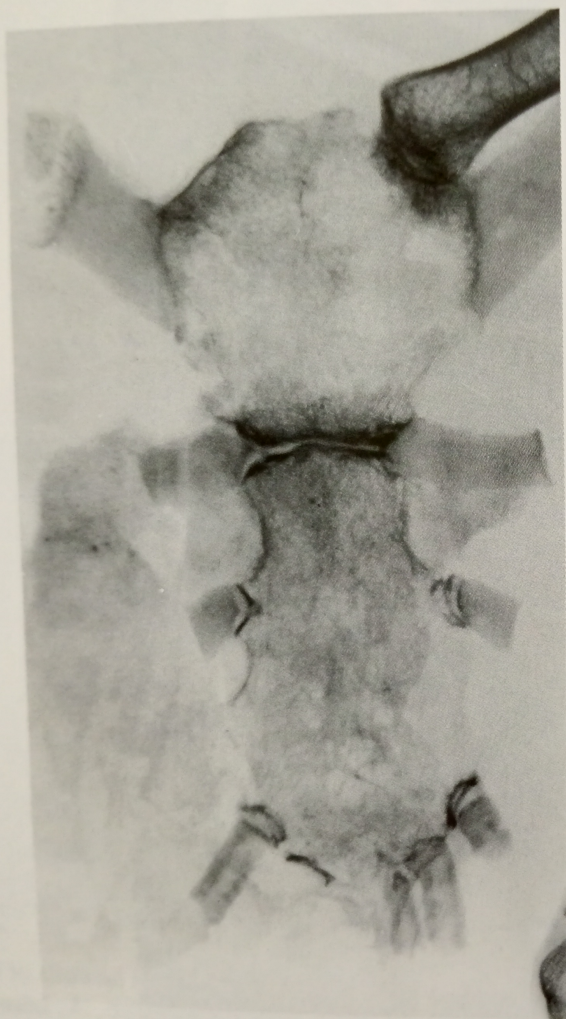
2. Pieces of soft tissue, possibly from one of the shoulder regions, external (*top*) and internal views.



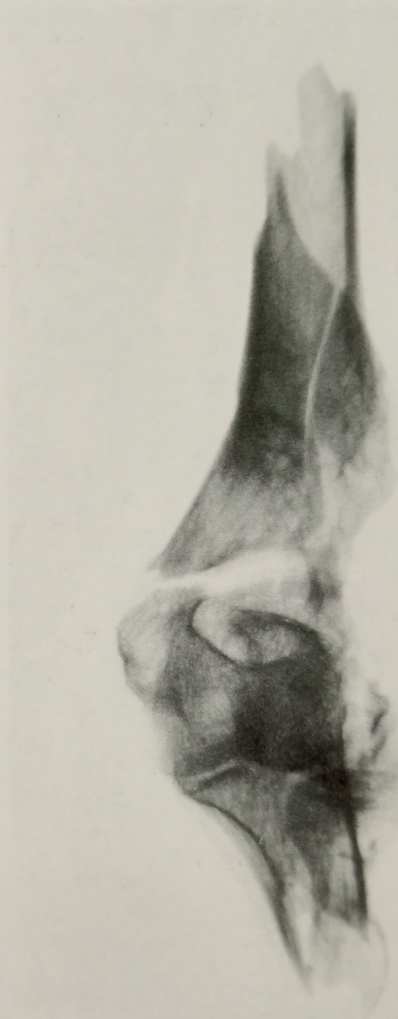
3. Fragment of a textile pad covered by lime with an adhering tubular bead (*left*), and an isolated lumbar vertebral disc (*right*).



4. A spheric oblong object (bag?), external (*left*) and internal (*right*) views.



3. Radiogram of the sternum with attached left clavicle and ribs.



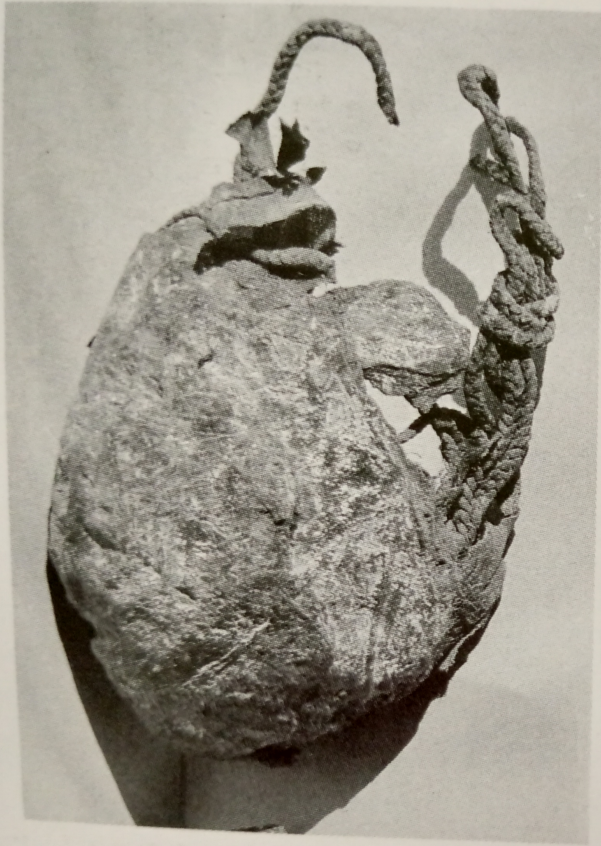
4. Radiogram of the postmortally-broken left cubit region.



1. Antero-posterior radiogram of the cervical and upper thoracic spine.

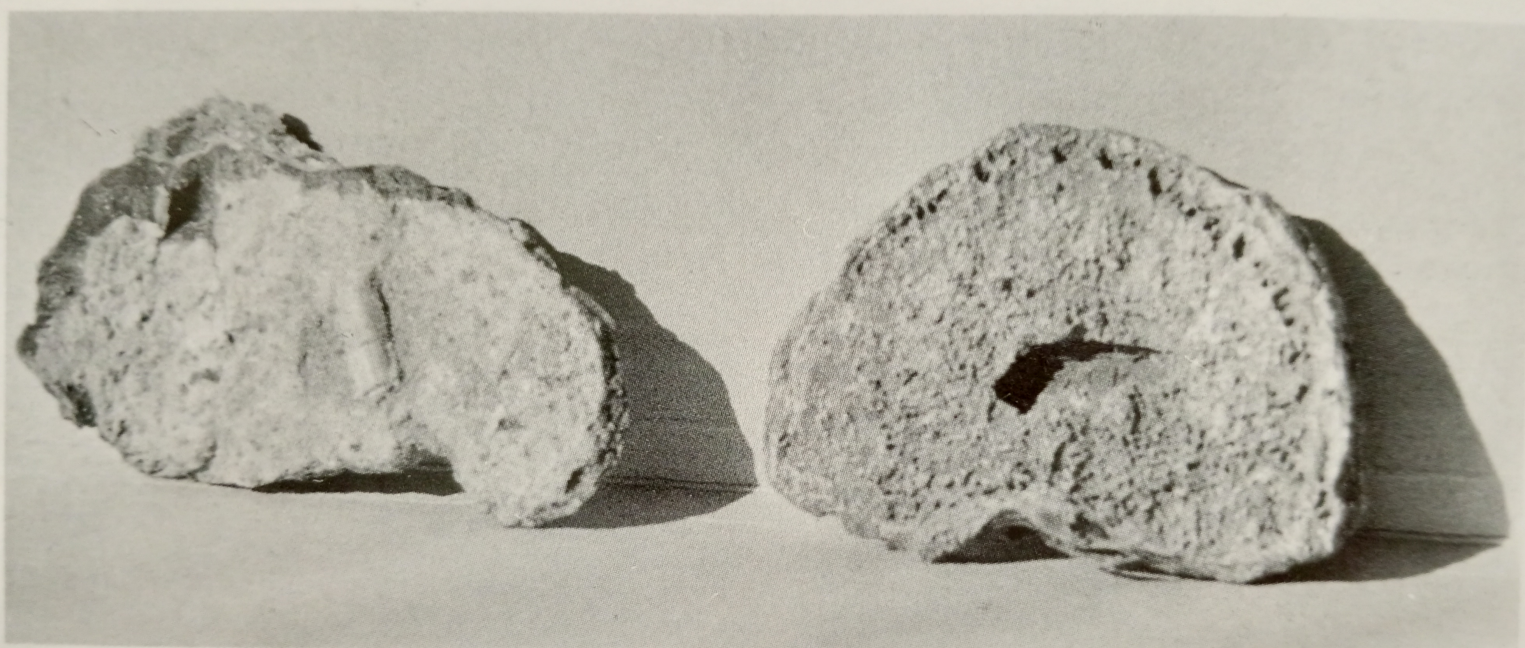


2. Lateral radiogram of the cervical and upper thoracic spine.

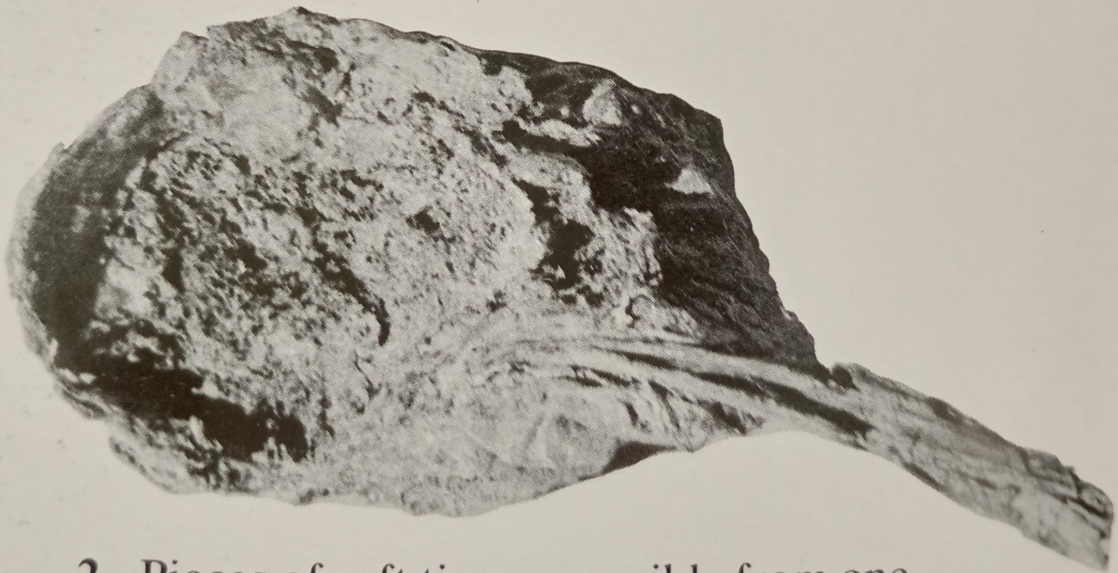


4. A spheric oblong object (bag?), external (*left*) and internal (*right*) views.

of the shoulder regions, external
and internal views.



3. Fragment of a textile pad covered by lime with an adhering tubular bead (*left*), and an isolated lumbar vertebral disc (*right*).



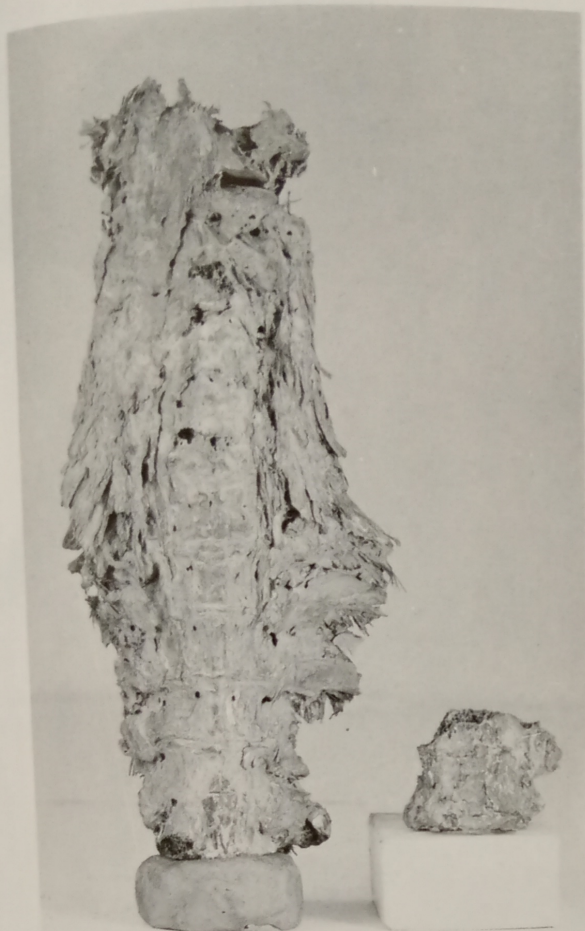
2. Pieces of soft tissue, possibly from one of the shoulder regions, external (*top*) and internal views.



1. The lateral half of the left foot from naviculare to tips of toes.



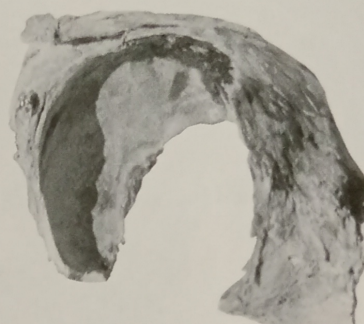
1. The lateral half of the left foot from naviculare to tips of toes.



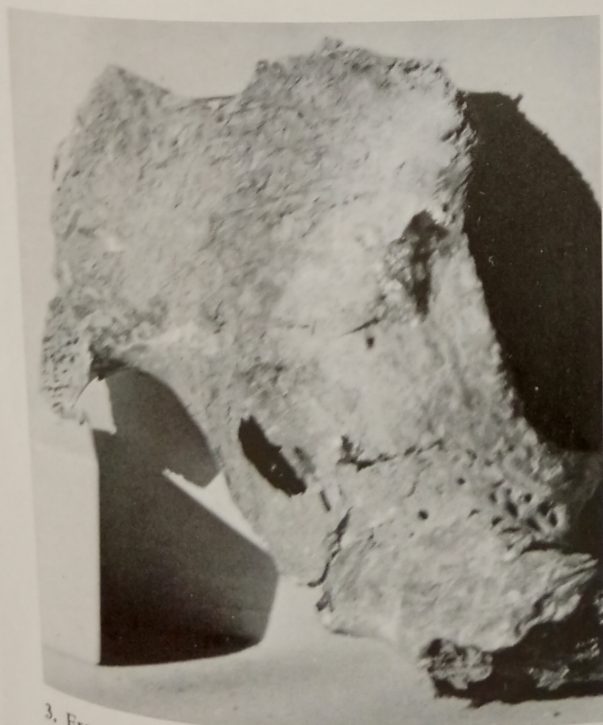
1. The cervical and upper thoracic spine with preserved soft tissue and isolated fragment of distal T₆ connected with T₇ in anterior view.



2. Fragment of the distal end of the left humerus and proximal ends of both antebrachial bones.



4. Fragment of the proximal end of the left femur with the originally adhering rim of the left acetabulum.



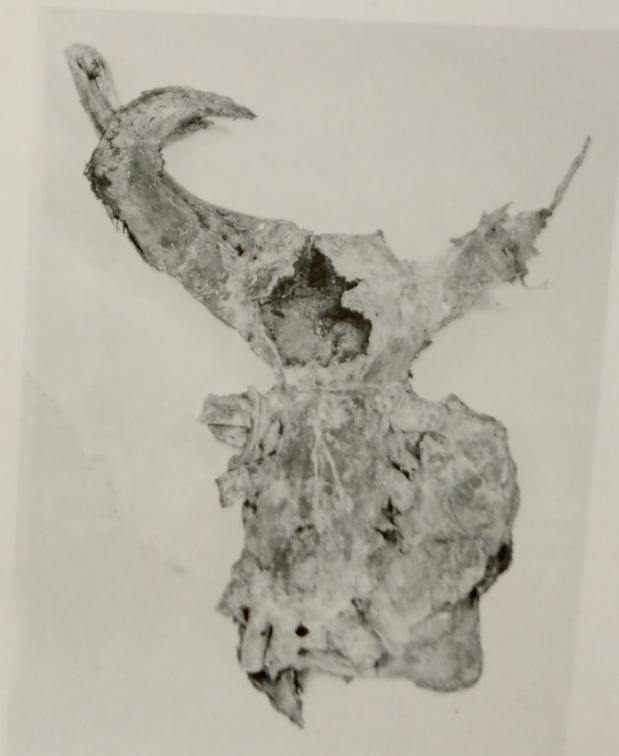
3. Fragment of the right os coxae.



1. The left half of the mandible with two molars in situ.

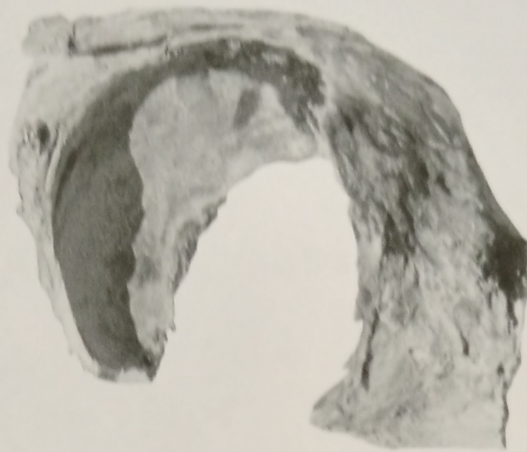


2. The sternum covered by soft tissue, textile and stucco with attached left clavicle and rib fragments, external view.



3. The sternum covered by soft tissue with attached left clavicle and rib fragments, internal view.

2. Fragment of the distal end of the left humerus and proximal ends of both antebrachial bones.

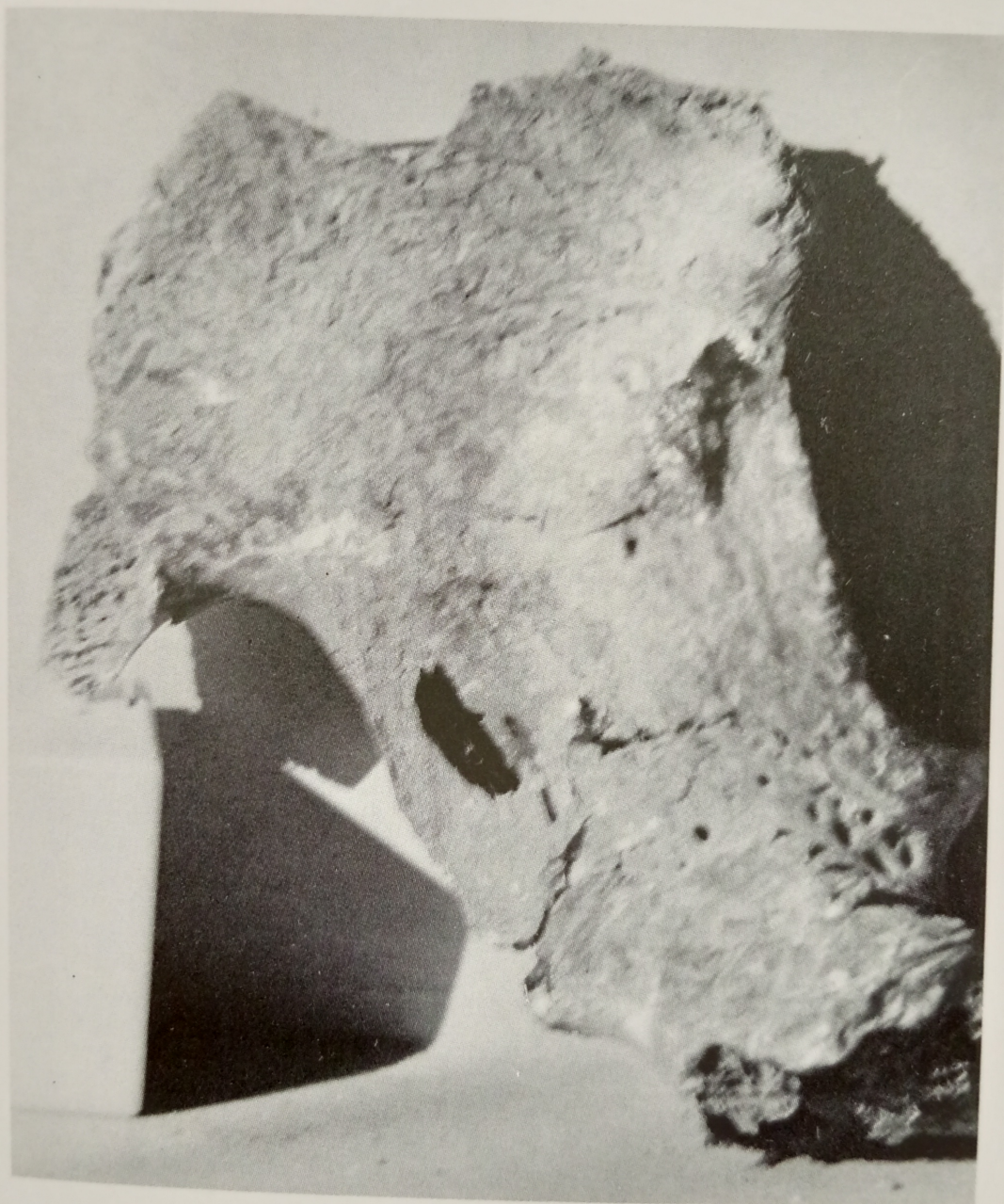


th preserved
6 connected



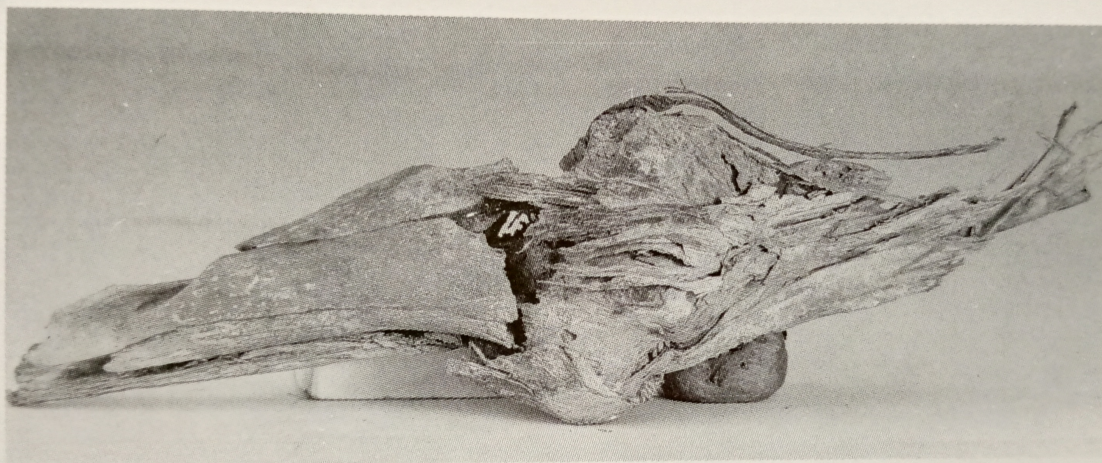
4. Fragment of the proximal end of the left femur with the originally adhering rim of the left acetabulum.

1. The cervical and upper thoracic spine with preserved soft tissue and isolated fragment of distal T₆ connected with T₇ in anterior view.

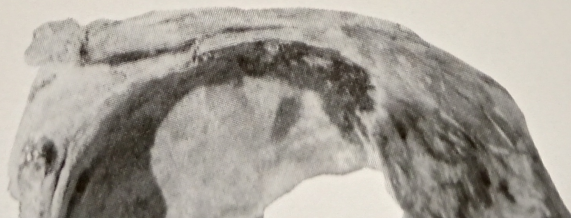


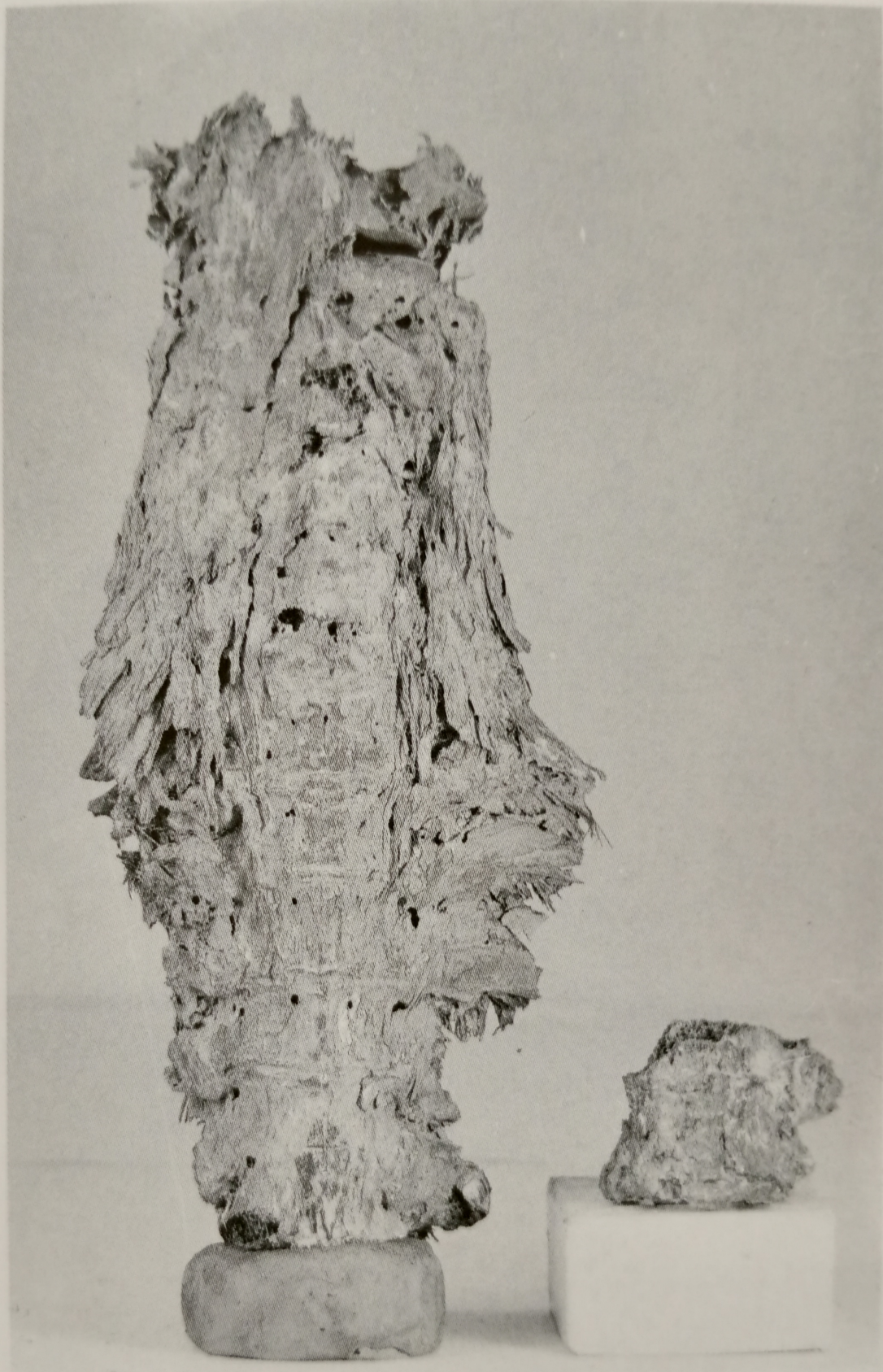
3. Fragment of the right os coxae.

PLATE 11

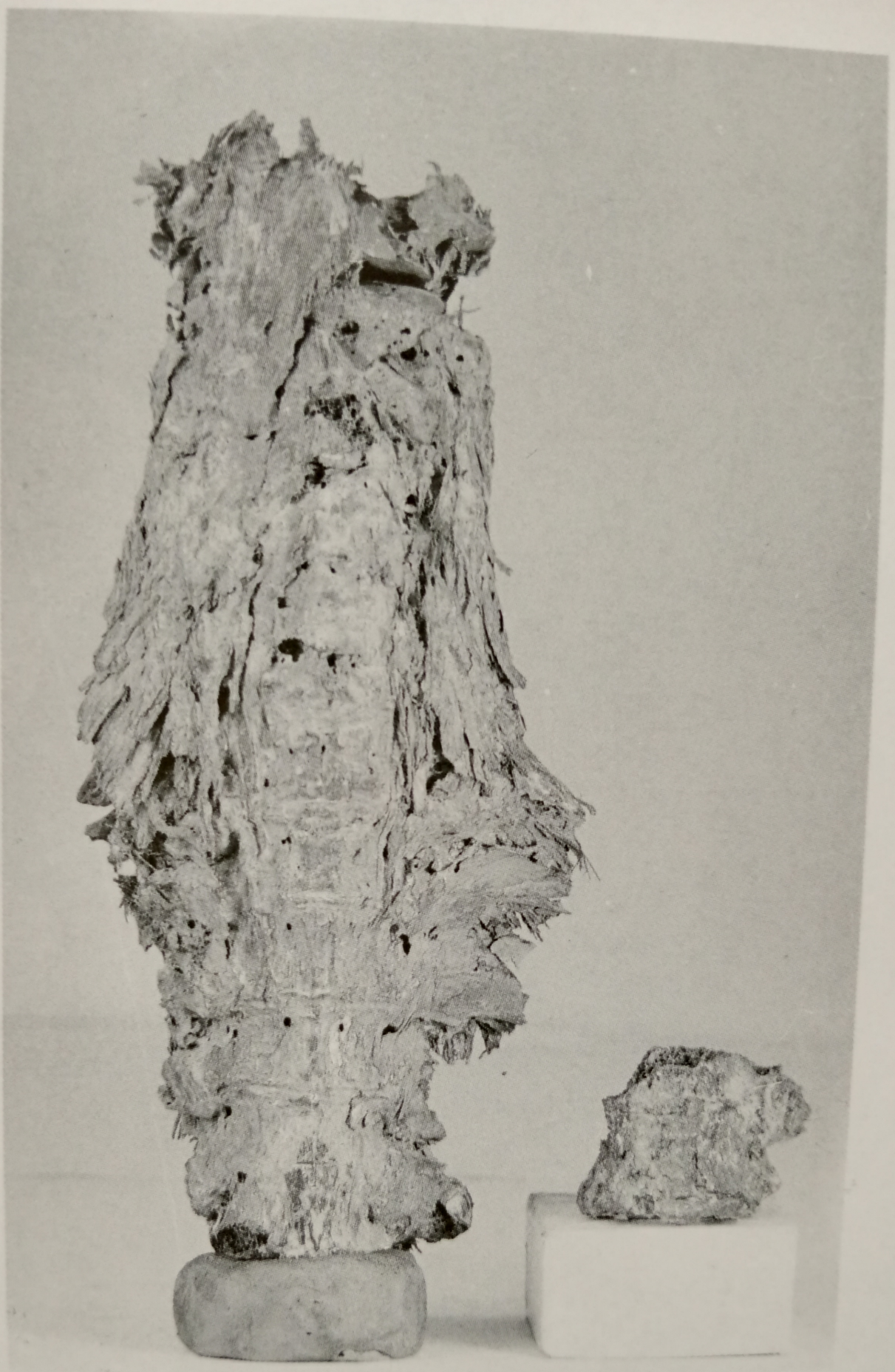


2. Fragment of the distal end of the left humerus and proximal ends of both antebrachial bones.

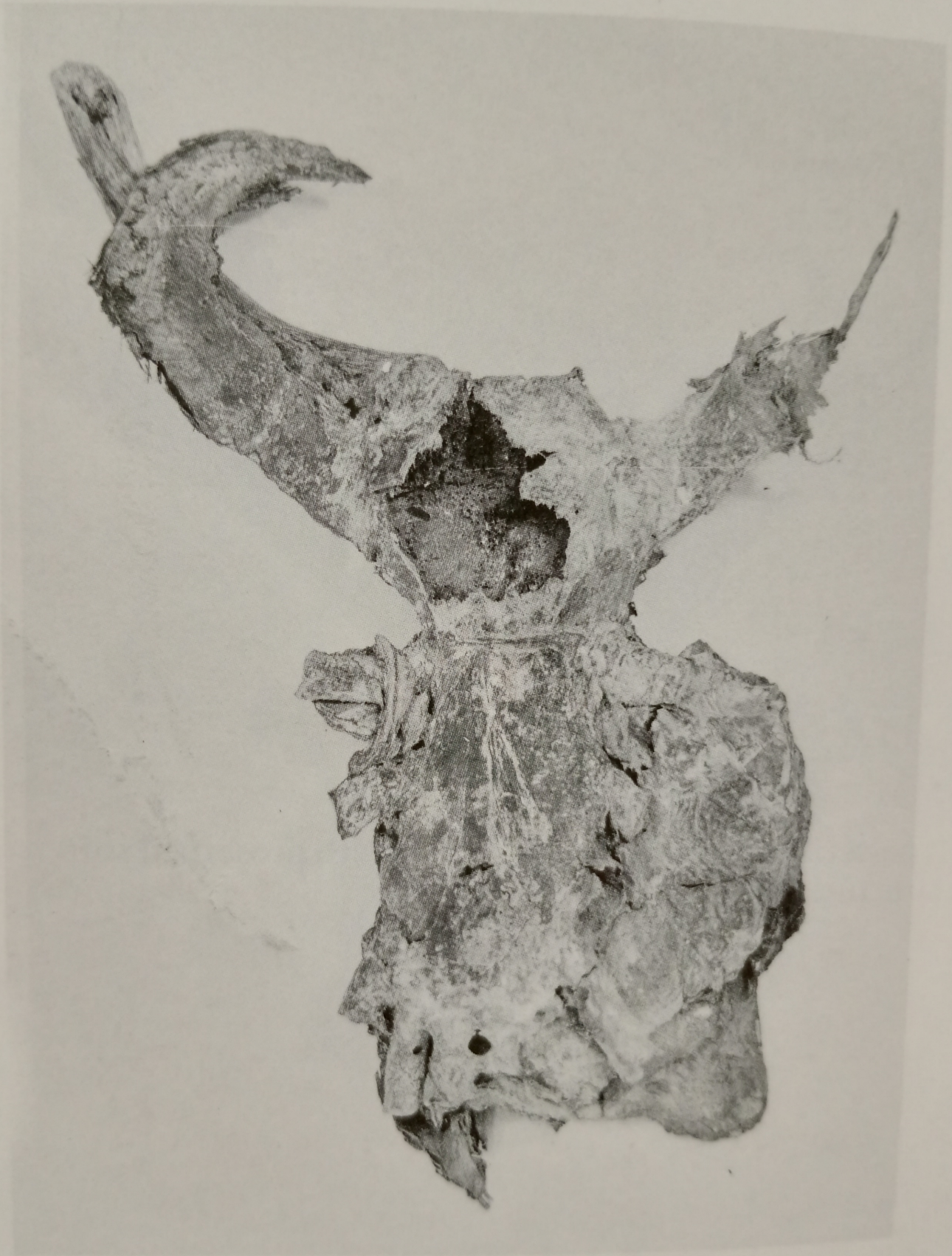




1. The cervical and upper thoracic spine with preserved soft tissue and isolated fragment of distal T₆ connected with T₇ in anterior view.



1. The cervical and upper thoracic spine with preserved soft tissue and isolated fragment of distal T₆ connected with T₇ in anterior view.



3. The sternum covered by soft tissue with attached left clavicle and rib fragments, internal view.



2. The sternum covered by soft tissue, textile and stucco with attached left clavicle and rib fragments, external view.

3. The clavicle



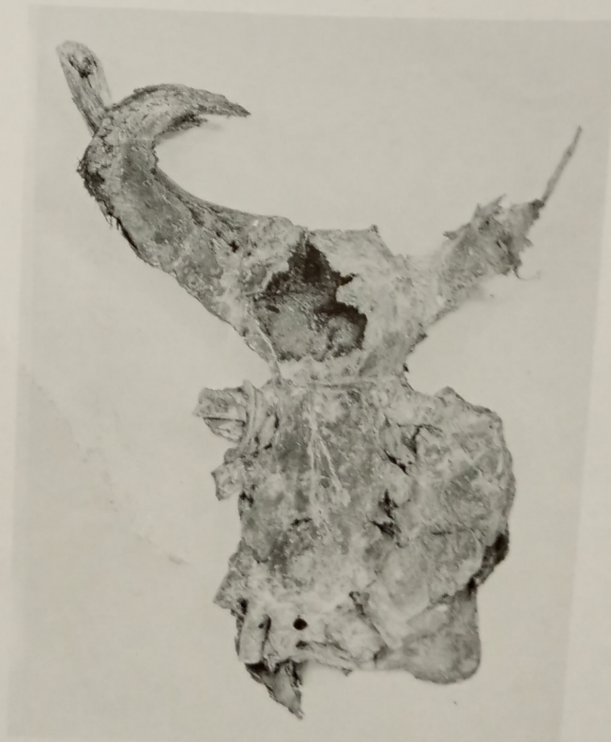
1. The left half of the mandible with two molars in situ.



1. The left half of the mandible with two molars in situ.



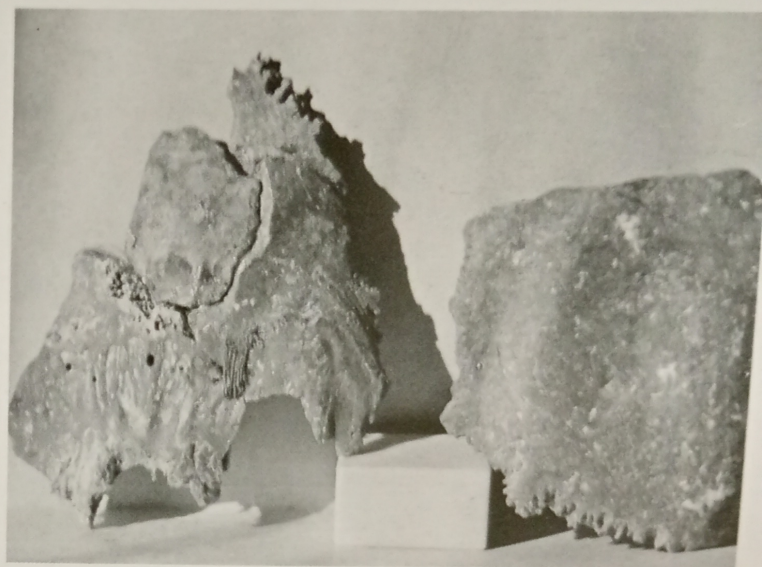
2. The sternum covered by soft tissue, textile and stucco with attached left clavicle and rib fragments, external view.



3. The sternum covered by soft tissue with attached left clavicle and rib fragments, internal view.



1. The anterior half of King Djedkare Isesi's calva.



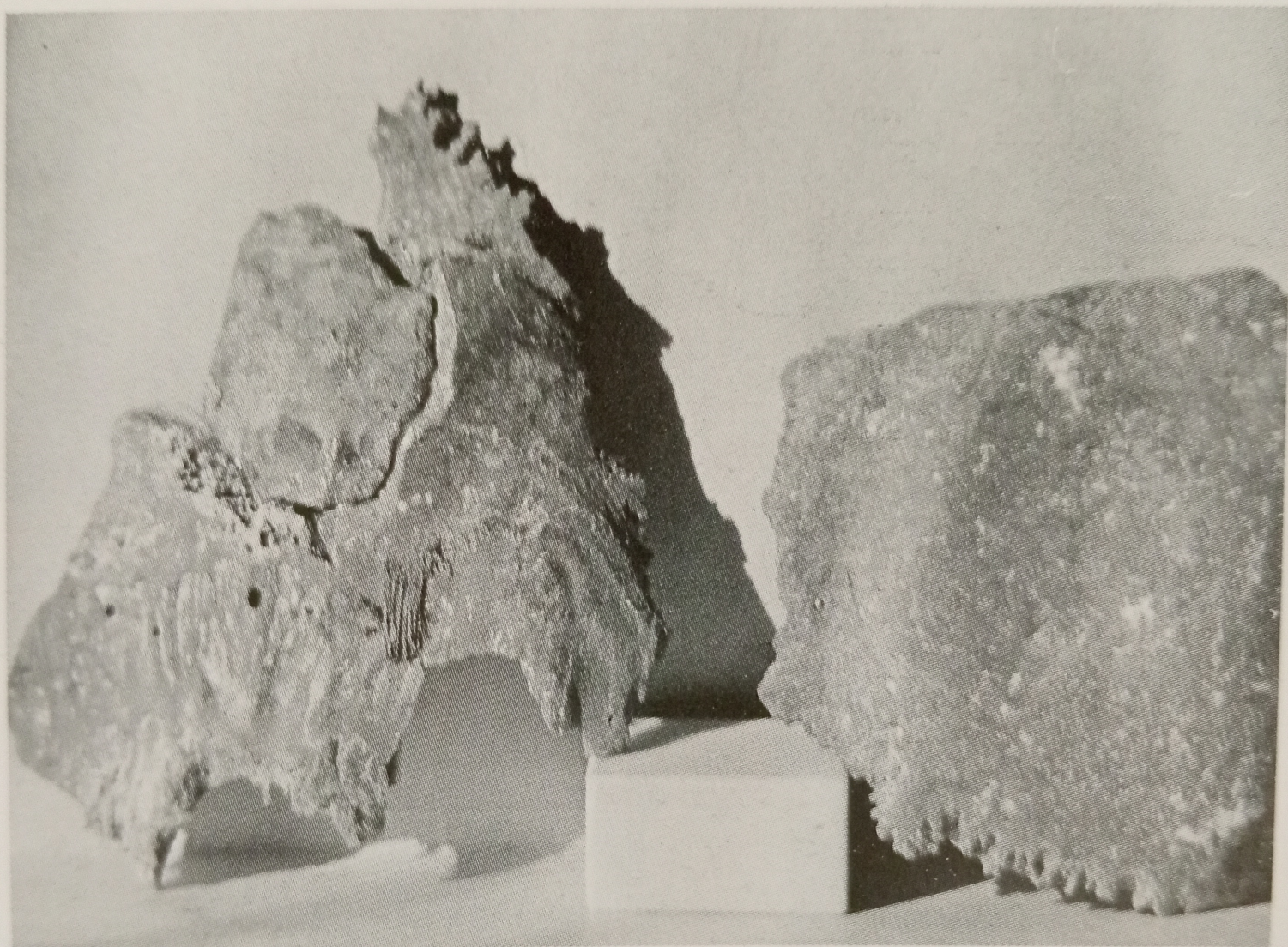
2. The incomplete squama occipitalis (*left*) and right parietale (*right*).



3. Left posterior inferior part of the face with preserved soft tissue structures including the auricle.



4. Part of the right maxillar alveolar process with teeth in situ.



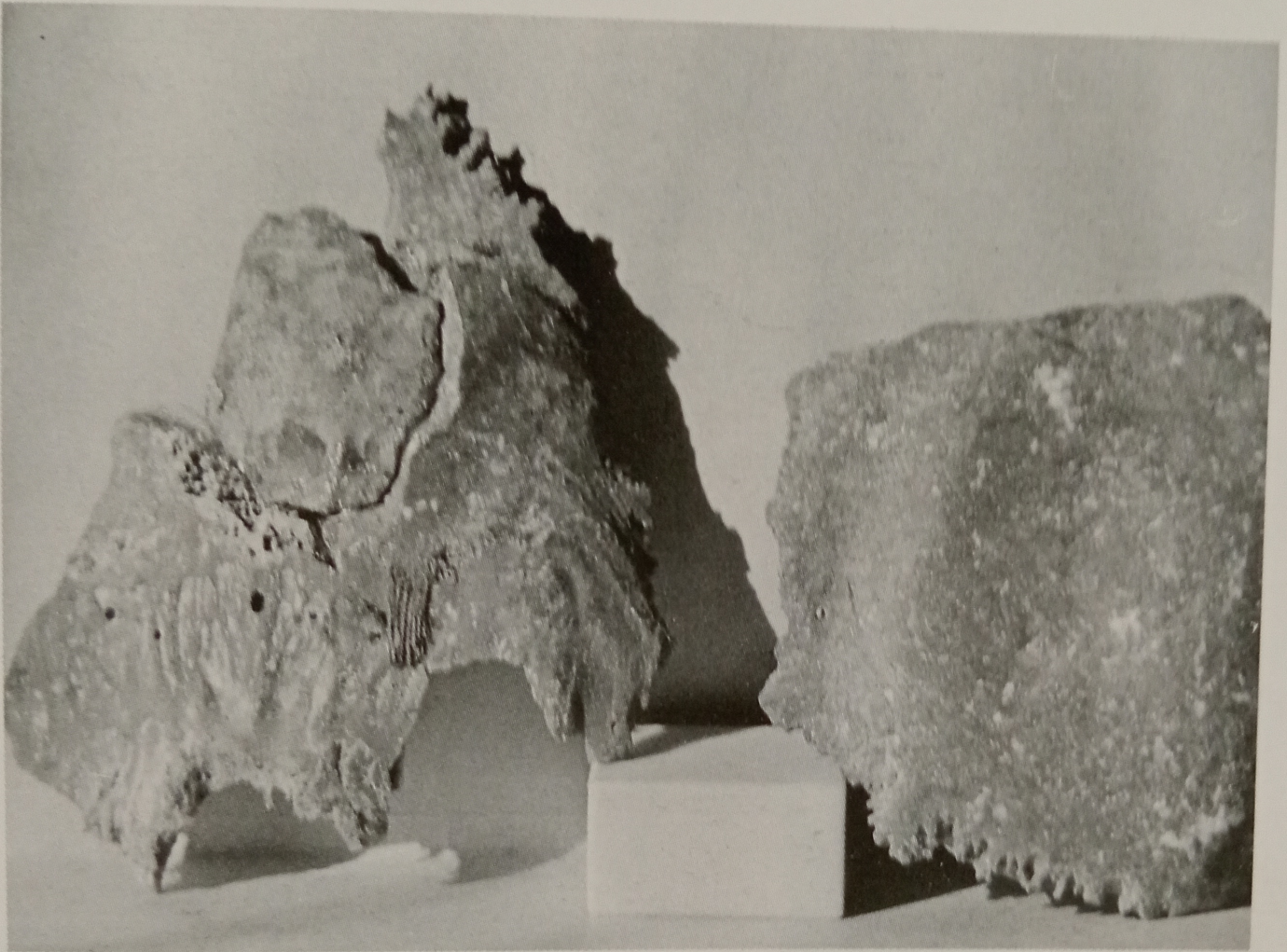
2. The incomplete squama occipitalis (*left*) and right parietale (*right*).



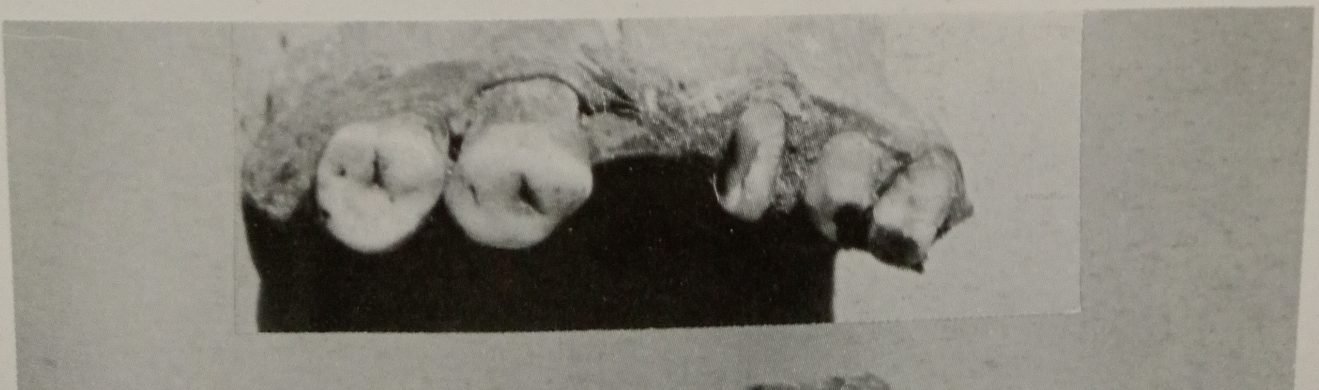
1. The anterior half of King Djedkare Isesi's calva.

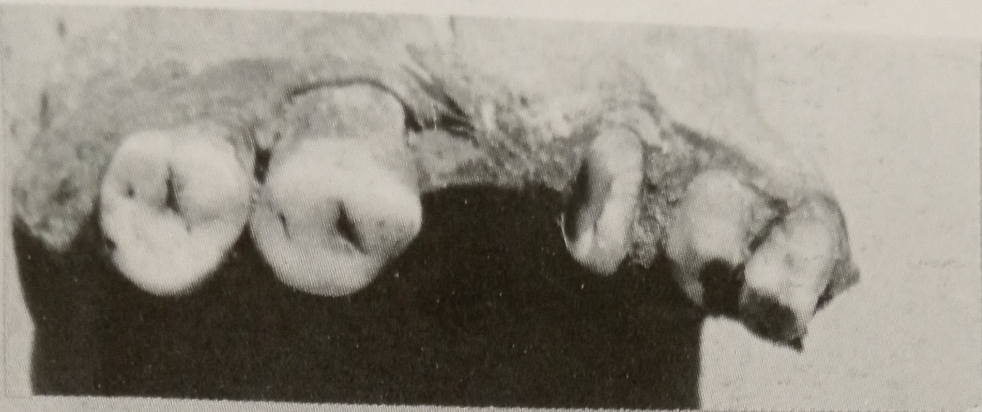


3. Left posterior inferior part of the face with preserved soft tissue structures including the auricle.



2. The incomplete squama occipitalis (*left*) and right parietale (*right*).





4. Part of the right maxillar alveolar process with teeth in situ.

1. The anterior half of King Djedkare Isesi's calva,



3. Left posterior inferior part of the face with preserved soft tissue structures including the auricle.

4. Pa



1. The anterior half of King Djedkare Isesi's calva.

